Jinko ESS Liquid Cooling Solution of Micro-grid AC- coupled System

250kW/645kWh Li-ion BESS Project in Lebanon

Case Study

Project Overview

The project is situated in a rural area of Lebanon, characterized by extensive land and low population density where grid power is not available, and the facility is running only on diesel generators.

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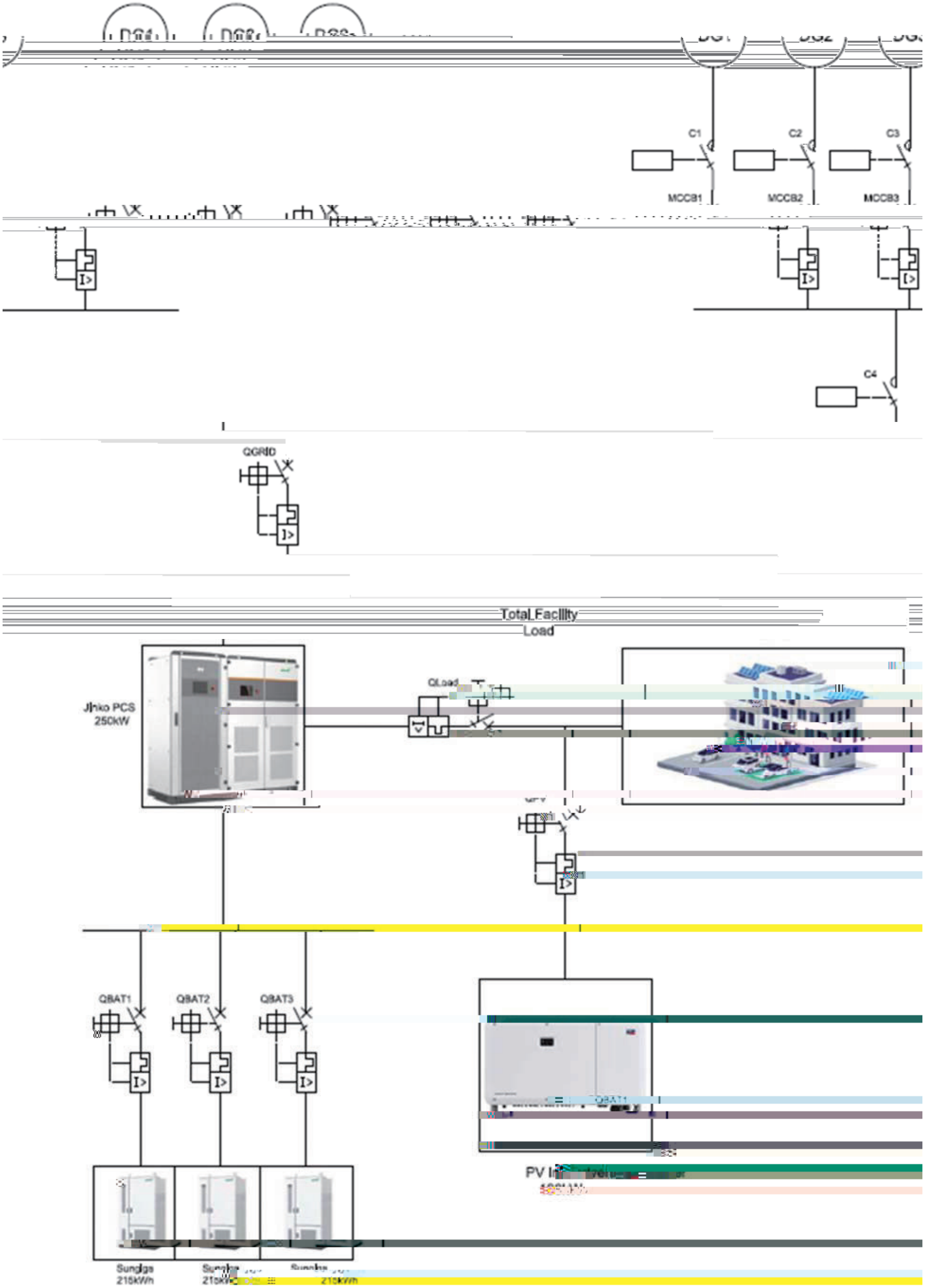

Fig. 1 Single Line Diagram of Micro-grid AC-Coupled System

Adopting 645kWh Jinko SunGiga energy storage cabinets, the client will benefit from the inherent advantages of its integrated design, simplified installation and maintenance procedures, while achieving a high level of system integration.

The 645kWh ESS system is designed in cabinets configuration, integrated with different sub systems to deliver optimal performance and safety. These include battery racks, battery management system (BMS), liquid cooling system, fire suppression system, power conversion system (PCS) and energy management system (EMS).

Battery Rack

Each battery rack of 215kWh consists of 5 battery packs of 153.6V rated voltage connected in series to reach a total 768V. Alongside a high voltage box (HVB) consisting of electrical protection for high and low voltage circuit and a battery cluster unit (BCU) responsible for collecting and processing data received from the battery pack units.

Battery Management System

The solution adopts a BMS with two stage architecture using CAN bus communication: battery management unit (BMU) and battery cluster unit (BCU).

The BMU is integrated into each pack to monitor the cell voltages, temperature and current. The BCU is integrated into the HVB summarizing the data received by the BMUs.

The BMS is responsible for real time detection of thermal and electrical parameters (voltage, current, temperature, etc...), accurate estimation of battery state of charge (SOC) and state of health (SOH) with auto calibration and support over-charge protection, over-discharge protection, short circuit protection, reverse polarity protection, overload protection, and over-temperature protection.

The BMS can swiftly isolate local faults, report fault information and provide real time alarms.

Fig. 2 BMS Communication Topology

Liquid Cooling System

The solution adopts a liquid cooling system, which consists of liquid cooling host, liquid transmission pipeline and battery liquid cooling plate, and multi-mode refined thermal management control logic to maintain normal temperature and improve system consistency and lifetime. The liquid cooling unit has a low rated capacity pf 4kW.

Fire Suppression System

The fire suppression system integrated within the ESS

Fig. 4: PCS Single Line Diagram

Energy Management System (EMS)

The EMS integrated with the ESS system offers a comprehensive range of functionalities to ensure efficient and reliable operation. It serves as a central control unit that optimizes energy flow, enhances system performance, and enables seamless integration with existing SMA PV inverters.

The EMS provides real-time monitoring and control of the system, allowing users to monitor crucial parameters, such as state of charge (SOC), state of health (SOH), and power flow. Through a user-friendly visual interface, users can directly manage and adjust system settings, ensuring optimal performance and maximizing energy utilization.

The EMS plays a critical role in optimizing the operation of the ESS system to ensure efficient management between PV inverters, battery cabinets and DGs existing on site.

The BMS, PCS and PV inverters are connected to the EMS through Modbus TCP/IP. The EMS is communication with the existing DG through hard wiring configurable dry contact based on batteries state of charge % (SOC).

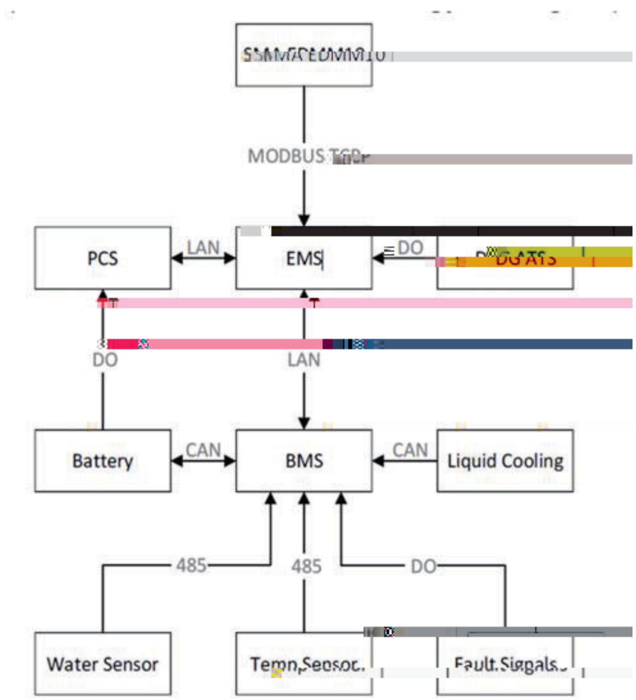

Fig. 5: EMS Communication Topology

The system will run in off grid mode during the day when the PCS switches to grid forming mode to give the PV inverters constant voltage and frequency to charge the batteries and feed the facility load.

As the PV capacity of 180kW is less than the maximum allowable charging capacity, the EMS will send 100% power setpoint to PV inverters when the battery SOC is between 0 and 90%.

At 90% SOC, the EMS will start limiting the charging from PV by sending power setpoint to the PV inverters equal to:

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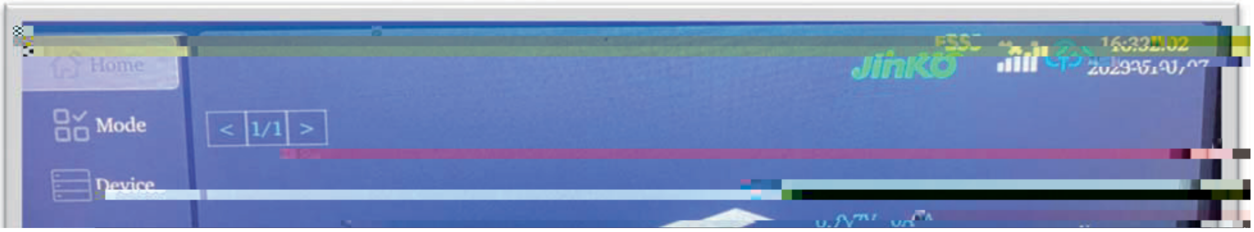

Fig. 5: EMS HMI Display

Fig. 6: EMS PV Inverters Power Limit Thresholds.

SCU Monitoring

The solution is equipped with one SCU connected to the 3 battery cabinets to monitor and control all connected subsystems (cooling system, FSS, BMUs, BCUs, etc é) and provide real time data for cluster and cells voltage, temperature and current as well as the as the alarms log and running status of the SunGiga cabinets.

The SCU is connected to cloud via LAN cable connected to the client router. The SCU is accessed remotely through VPN.

Fig. 6: SCU Cloud Monitoring Display

Fig. 8: EMS Cloud Monitoring Platform

20%ÒSOCÒ90

The PV inverters are working at 100% active power setpoint since the system SOC % is less than the power limit 1st threshold (90%) as shown in the figure 9 below:

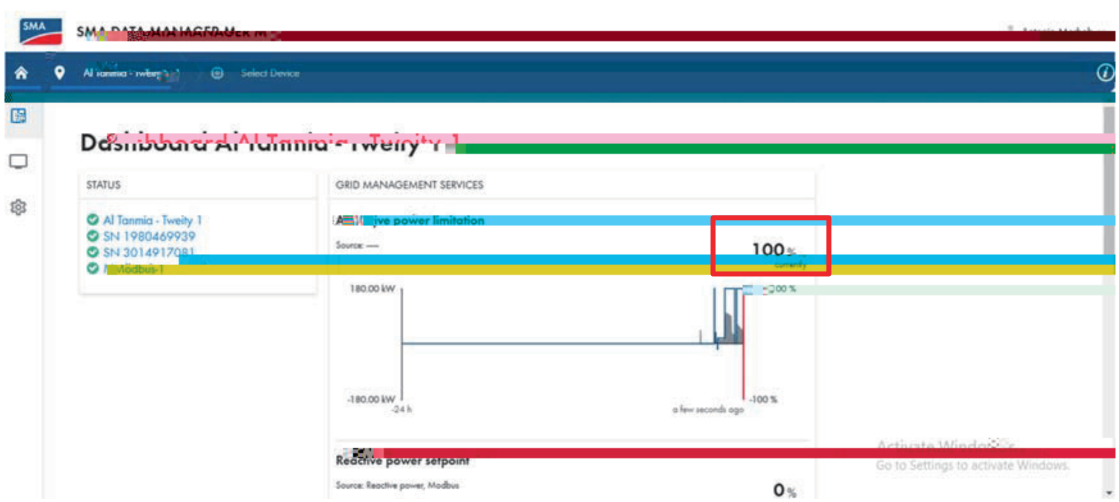

Fig. 9: SMA Monitoring platform showing 100% setpoint received from EMS

90%ÒSOCÒ95

In this case PV inverters charging power will be limited to 75kW (30% of PCS capacity), taking into consideration a load power of 35kW. As shown in figure 10 below, the PV inverters power setpoint received is 66% of PV total capacity which makes sense based on the load power: